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ORIGINAL

FLOOD INSURANCE STUDY

COMPLETED
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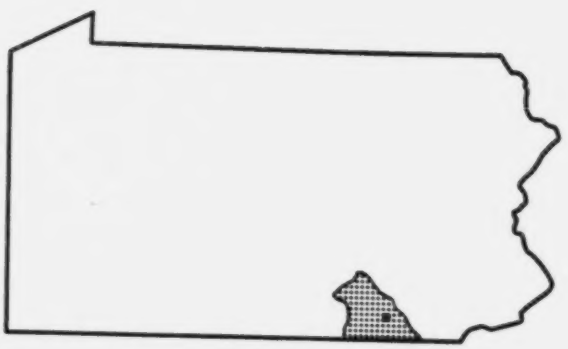
BOROUGH OF WINDSOR, PENNSYLVANIA
YORK COUNTY



MAY 3, 1982

Federal Emergency Management Agency

COMMUNITY NUMBER · 420942

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map

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FLOOD INSURANCE STUDY

BOROUGH OF WINDSOR, PENNSYLVANIA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Borough of Windsor, York County, Pennsylvania, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert Windsor to the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3. In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Gannett, Fleming, Corddry, and Carpenter, Inc., for the Federal Emergency Management Agency, under Contract No. H-4820. This study was completed in May 1981. All field surveys and aerial mapping were performed by or under the direction of Quinn and Associates of Horsham, Pennsylvania.

1.3 Coordination

Upon the initiation of the study, a legal notice was placed in the York Dispatch one day a week for three consecutive weeks, beginning August 28, 1979, to notify all interested persons to submit any relevant facts and technical data concerning local flood hazards.

Streams requiring detailed study were identified at a meeting attended by representatives of Gannett Fleming Corddry and Carpenter, Inc. (the study contractor), the FEMA, and the Borough of Windsor on June 8, 1978. During the course of the study contacts were made with the Susquehanna River Basin Commission (SRBC), the U. S. Geological Survey (USGS), the York County Planning Commission, the FEMA, and residents of the Borough of Windsor.

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On August 19,1981, the results of the study were reviewed at the final meeting attended by representatives of the study contractor, the FEMA, and community officials. The study was acceptable to the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Borough of Windsor, York County, Pennsylvania. The area of study is shown on the Vicinity Map (Figure 1).

The limits of detailed and approximate studies in Windsor were determined by the FEMA with community and study contractor consultation at the meeting in June 1978.

Floods caused by overflow of Fishing Creek from the downstream corporate limits of Windsor to the upstream corporate limits were studied in detail. The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction for the next five years, through May 1986. Flooding on Tributary A within the Borough limits was studied by approximate methods. Approximate methods of analyses were used to study areas having a low development potential or a minimal flood hazard.

2.2 Community Description

The Borough of Windsor is located in east central York County, in south central Pennsylvania. The total land area contained within the borough limits is 0.53 square miles. Borough of Windsor is situated approximately 9 miles east-southeast of the City of York, and 28 miles south of Harrisburg, Pennsylvania; it is completely surrounded by Township of Windsor. According to U. S. Census Bureau figures, the population has increased from 1,029 in 1960 to 1,298 in 1970, which represents a 26.1 percent increase (Reference 1). The Borough of Windsor is located in the Piedmont Province of Pennsylvania which is characterized by gently rolling hills and an undulating terrain. The range in local elevation varies from 620 feet NGVD in the eastern portion of the borough, to over 800 feet NGVD in the southwestern corner of the borough. The land form is a result of geologic activity in which huge layers of rock were folded upwards by tremendous amounts of internal pressure. Erosion from climatic elements have gradually worn down the sharper protrusions to form the rounded hills.

The entire surface area of the borough is drained by Fishing Creek which is a tributary to the Susquehanna River, having its confluence about 5.5 miles upstream of the Safe Harbor Dam. Fishing Creek, which was studied by detailed methods, has a drainage area, at its confluence with the Susquehanna River, of 19.1 square miles and a

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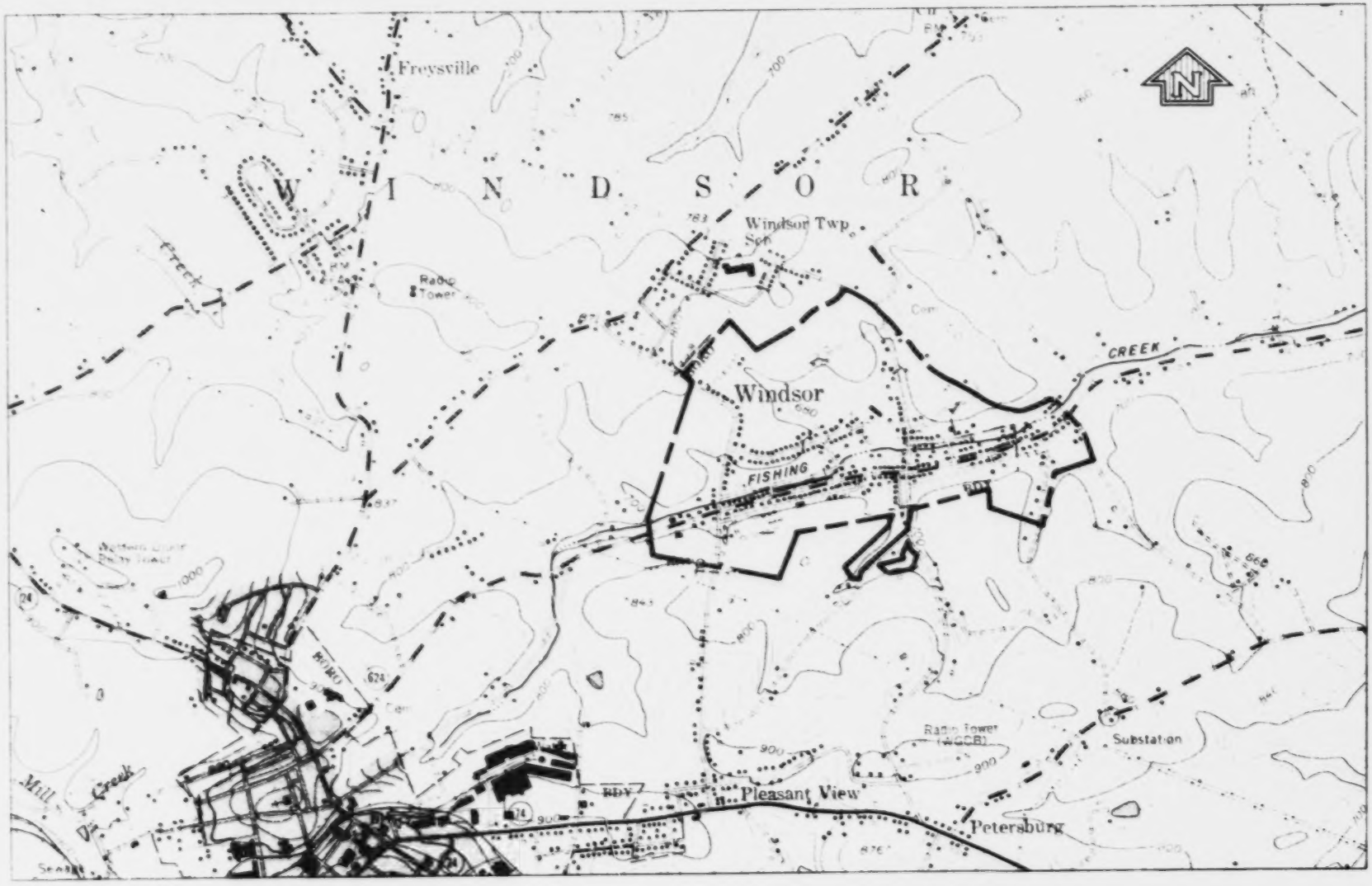

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF WINDSOR, PA
(YORK CO.)

APPROXIMATE SCALE
2,000' 0 2,000' 4,000' 6,000'

VICINITY MAP

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drainage area of 2.61 square miles at the downstream corporate limits of Borough of Windsor. It flows eastward about 10 miles from its point of origin, near the north eastern boundary of Red Lion, to the Susquehanna River and falls roughly 560 feet in that distance. Approximately seventy-five percent of the borough has been developed with the remainder of land being vacant or wooded. Within the flood plains studied, development is residential with numerous garages adjacent to the stream.

The climate of south central Pennsylvania is characteristically humid continental. Summer and winter temperatures range from 66.8 degrees Farenheit (°F) to 24.7°F, respectively. Annual average precipitation of the region is 42 inches. The precipitation is fairly uniformly distributed throughout the year (Reference 2).

2.3 Principal Flood Problems

The past history of flooding on the streams within the Borough of Windsor indicates that flooding may occur during any season of the year. The majority of floods have occurred during late spring or early fall. Storms occurring during this period are often associated with tropical storms moving up the Atlantic coastline.

The floodplains of Fishing Creek within the Borough of Windsor have been extensively developed for residential use. Although no damage estimates or high water marks were available, flooding was reported by residents to have occurred in June 1972, September 1975 and August 1979. The June 1972 flooding was associated with the passage of Tropical Storm Agnes, which devastated the floodplains of much of the Susquehanna River Basin (Reference 3). The September 1975 flooding was associated with Tropical Storm Eloise which also caused severe damage throughout the Susquehanna River Basin (Reference 4). The flooding on August 1, 1979 was a result of intense thunder storm activity and was more localized. Photographs of potential flood levels at various locations within the Borough of Windsor are presented in Figures 2 and 3.

2.4 Flood Protection Measures

There are no flood control dams upstream of the Borough of Windsor in the Fishing Creek watershed; however, Fishing Creek has been channelized to increase its flow capacity at a number of locations throughout the borough. These man-made alterations to the natural stream were field measured and included in the hydraulic analysis.

Non-structural measures of flood protection are being utilized to aid in the prevention of future flood damage. These are in the form of land use regulations, adopted from the Code of Federal Regulations, which control building within areas that have a high risk of flooding (Reference 5).

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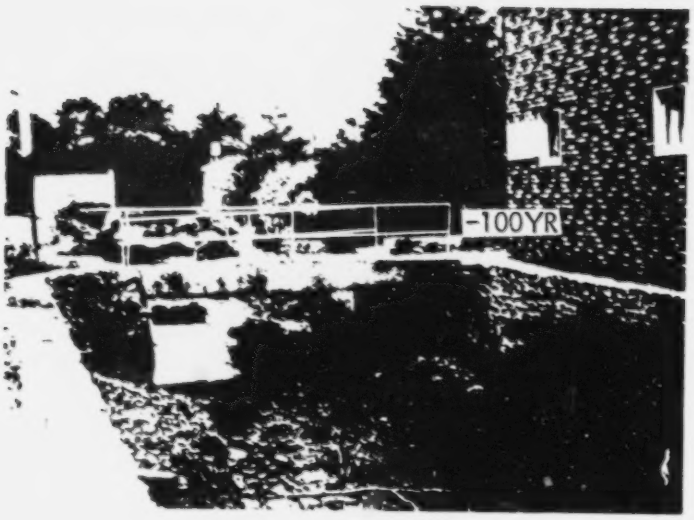

Figure 2. View of the downstream face of Myers Street Bridge over Fishing Creek in the Borough of Windsor. The estimated 100-year flood level is indicated and the 500-year flood level is 0.5 higher (photo date 7-79).

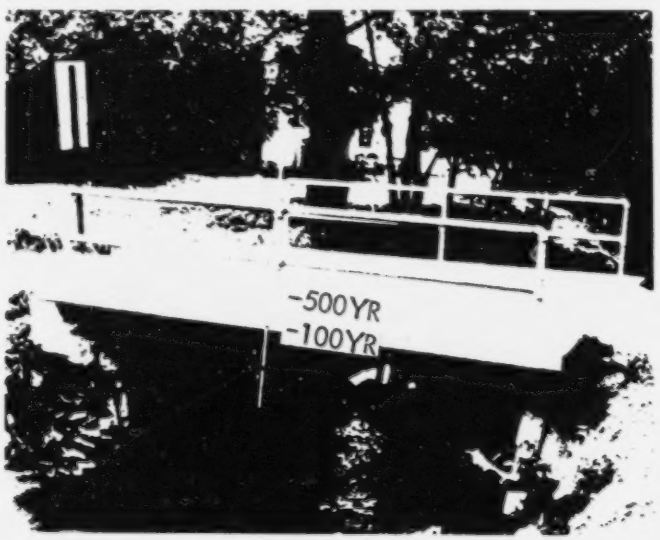

Figure 3. View of the downstream face of a private bridge over Fishing Creek. Bridge is located about midway between Penn Street and Heindel Street bridges over Fishing Creek in the Borough of Windsor. The estimated 100-year and 500-year flood levels are indicated (photo date 7-79).

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3.0 ENGINEERING METHODS

For the flooding source studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence intervals), have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50-year period is about 40 percent (four in 10), and for any 90 year period, the risk increases to about 60 percent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for floods of the selected recurrence intervals for the flooding source studied in detail in the community.

For the detailed study of Fishing Creek the hydrologic analysis consisted of the application of the hydrologic models presented in the U.S. Geological Survey Open File Report 76-391, Floods in Pennsylvania: A Manual for Estimation of Their Magnitude and Frequency (Reference 6). The empirical equations contained in the manual were developed through a regression analysis of frequency curves developed from gage data (Reference 7). These models relate flood flow frequency to drainage area, channel slope, percent area of storage and an index of average annual precipitation-evapotranspiration as the primary parameters for computing the peak flood discharges.

A summary of the drainage area-peak discharge relationships for Fishing Creek is presented in Table 1, "Summary of Discharges."

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TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
FISHING CREEK					
At Township Rte. 758 (Maryland Avenue)	2.61	329	576	709	1,150
At upstream corporate limits	1.07	135	228	277	435

Floodplain area delineations of approximate studies were determined as described in Section 3.2.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding source studied in detail in Borough of Windsor were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along the flooding source.

Composite cross sections for the backwater analyses of Fishing Creek were obtained from field surveys and photogrammetric compilations. The below-water sections were obtained by field measurement. All flow retarding bridges, dams, and culverts were field measured to obtain elevation data and structural geometry.

Channel roughness factors (Manning's "n") used in the hydraulic computations were assigned on the basis of field inspection of the streams and flood plain areas. The "n" values were selected based on channel conditions, overbank vegetation and land uses, using the National Engineering Handbook as a guide (Reference 8). Along Fishing Creek, the "n" values varied from 0.032 to 0.045 for the channel and 0.040 to 0.060 for the overbank areas of the flood plains.

The starting water surface elevations for Fishing Creek were obtained from the backwater computations for Township of Windsor (Reference 9).

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross-section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

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All elevations used in this study are referenced to the National Geodetic Vertical Datum of 1929 (NGVD), formerly referred to as mean Sea Level Datum of 1929. Locations of the elevation reference marks used in the study are shown on the maps.

For the streams studied by approximate methods, flooding determinations were identified after reviewing the Flood Hazard Boundary Map for the Borough of Windsor (Reference 10), the flood plain maps published by the York County Planning Commission (Reference 11), the "Regionalized Stage - Frequency Drainage Area Curves" (Reference 12) at selected locations along the streams and information supplied by local residents. The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are valid only if hydraulic structures remain unobstructed and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FEMA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For the stream studied in detail, the boundaries of the 100- and the 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using photogrammetric plotting instruments, aerial photography (Reference 13), and existing topographic maps at a scale of 1:24000 with a contour interval of 20 feet (Reference 14). In cases where the 100- and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

For the streams studied by approximate methods, the boundary of the 100-year flood was delineated on the topographic maps referenced above.

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2). Small areas within the flood boundaries may lie above the flood elevations, and therefore, may not be subject to flooding. Owing to limitations of the map scale and/or lack of detailed topographic data, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and

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increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of the FEMA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodway in this report is presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodway presented in this study was computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 4.

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ FT)	MEAN VELOCITY (FEET/SEC)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
A	85	56	252	2.8	621.7	621.7	622.7	1.0
B	625	26	138	5.1	624.9	624.9	625.4	0.5
C	830	25	135	5.2	627.9	627.9	627.9	0.0
D	1680	36	125	5.7	633.4	633.4	633.4	0.0
E	2300	22	70	10.1	637.5	637.5	637.5	0.0
F	2980	43	129	5.5	644.8	644.8	645.0	0.2
G	3270	75	100	7.1	648.2	648.2	648.2	0.0
H	3470	45	104	6.8	650.5	650.5	650.5	0.0
I	3600	55	133	5.3	651.5	651.5	651.7	0.2
J	3800	45	105	6.8	653.3	653.3	653.4	0.1
K	4040	45	151	4.7	656.5	656.5	656.6	0.1
L	4405	41	167	4.2	660.0	660.0	660.6	0.6
M	4625	25	118	6.0	661.6	661.6	662.4	0.8
N	4975	65	276	2.6	666.5	666.5	666.8	0.3
O	5120	55	171	1.6	668.7	668.7	668.9	0.2
P	6000	23	47	5.9	676.2	676.2	676.2	0.0

[1] Distance in feet above corporate limits.

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF WINDSOR, PA
(YORK CO.)

FLOODWAY DATA

FISHING CREEK

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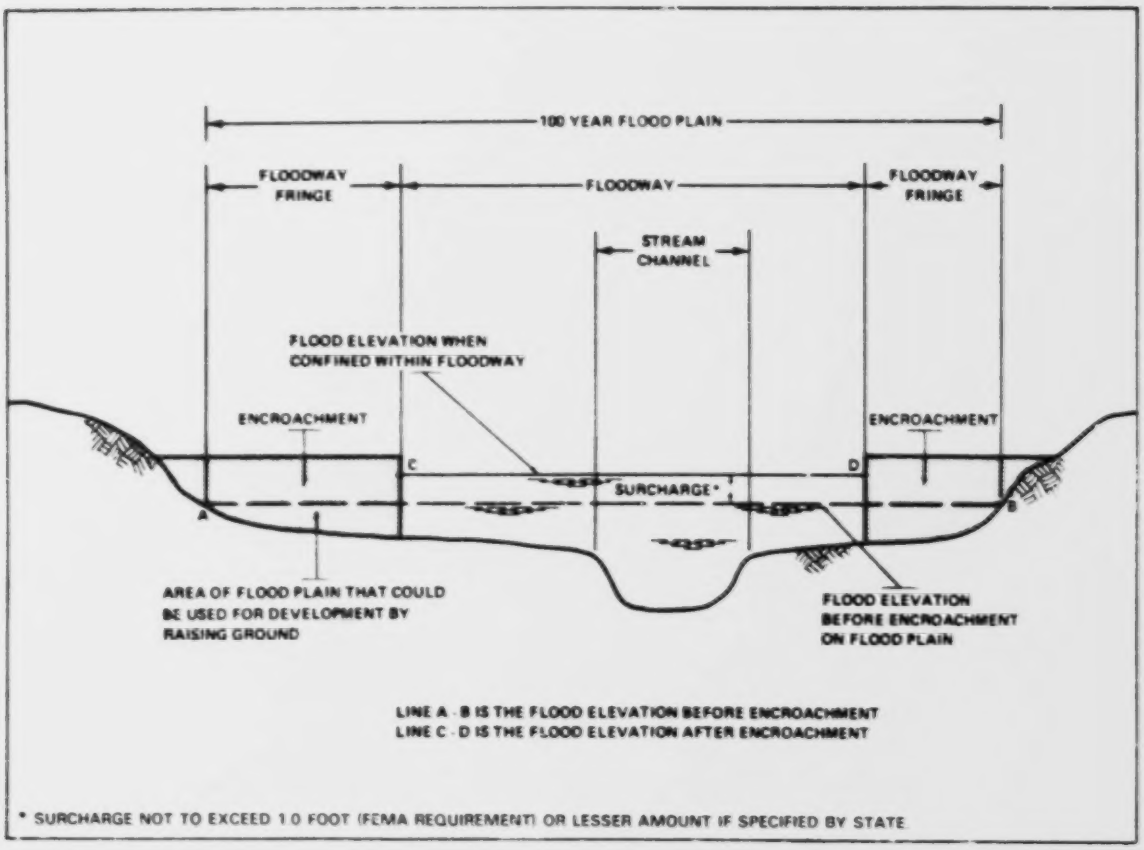
100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
* SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FLOODWAY SCHEMATIC Figure 4

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FEMA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each significant flooding source affecting the Borough of Windsor.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

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Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot

The locations of the reaches determined for the flooding source in the Borough of Windsor are shown on the Flood Profiles (Exhibit 1) and are summarized in the Flood Insurance Zone Data Table (Table 3).

5.2 Flood Hazard Factors (FHFs)

The FHF is the FEMA device used to correlate flood information with insurance rate tables. Correlations between property damages from floods and their assigned FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between the water surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water surface elevations is greater than 10.0 feet, the accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the Borough of Windsor was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods, no base flood elevations shown or FHFs determined.
Zone A4:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones assigned according to FHFs.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; areas

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3]
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Fishing Creek Reach 1	01	-2.0	-0.58	+1.93	020	A4	varies

[1] Flood Insurance Rate Map Panel

[2] Weighted Average

[3] Rounded to the nearest foot - see Map

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF WINDSOR, PA
(YORK CO.)

FLOOD INSURANCE ZONE DATA

FISHING CREEK

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Zone B (cont'd):	subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; or, areas subject to 100-year flooding from sources with drainage areas of less than one square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data, " summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding source studied in detail in the Borough of Windsor.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Borough of Windsor is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FEMA.

6.0 OTHER STUDIES

A Flood Insurance Study has been prepared for Township of Windsor, which surrounds Borough of Windsor. The results of this study are compatible with the study for the Township of Windsor. The most current community maps for the Borough of Windsor were used when compiling the mapping for this study. No other pertinent studies covering the Borough of Windsor were found to exist at the time of this report.

7.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, Regional Director, Curtis Building, Room 700, Sixth and Walnut Streets, Philadelphia, Pennsylvania 19106.

8.0 BIBLIOGRAPHY AND REFERENCES

1. U. S. Department of Commerce, Bureau of the Census, 1970 Census of Population, Number of Inhabitants, Pennsylvania, Washington, D. C., 1971.

2. U. S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Data Service, Monthly Averages of Temperature and Precipitation for State (Pa.) Climatic Divisions, 1941-1970.

BEST DOCUMENT AVAILABLE

3. U. S. Department of the Interior, Geological Survey, Water Resources Data for Pennsylvania, Part 1, Surface Water Records, 1961-1975.

4. Department of Environmental Resources, Commonwealth of Pennsylvania, "Hydrologic Data of the June 1972 Flood in Pennsylvania," Water Resources Bulletin No. 9, August 1974.

5. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Code of Federal Regulations, Title 24, Chapter 10, Parts 1910.3A and 3B, Federal Register, Vol. 41, No. 207, Revision 1976.

6. U. S. Department of the Interior, Geological Survey, Floods in Pennsylvania: A Manual for Estimation of Their Magnitude and Frequency, Open-File Report 76-391, May 1976.

7. U. S. Water Resources Council, "Guidelines for Determining Flood Flow Frequency," Bulletin No. 17, Hydrology Committee, March 1976.

8. U. S. Department of Agriculture, Soil Conservation Service, National Engineering Handbook, Section 5, Washington, D.C. 1964 revised 1972.

9. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, Township of Windsor, York County, Pennsylvania (Unpublished).

10. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Borough of Windsor, York County, Pennsylvania, Washington, D.C., January 23, 1974, revised January 16, 1976.

11. York County Planning Commission, Floodplains, A Topical Study on York County, York, Pennsylvania, June 1974.

12. Regionalized Stage - Frequency Drainage Area Curves Developed From Water Supply Papers 1675-77, 1961.

13. Aerial photography, Quinn and Associates, Horsham, Pennsylvania (1979).

14. U. S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 20 Feet: Red Lion, Pennsylvania, 1953, Photorevised 1968 and 1973.

Chow, Ven T., Open-Channel Hydraulics, McGraw-Hill Book Company, 1959.

Commonwealth of Pennsylvania, Department of Forests and Waters, "Pennsylvania Gazetteer of Streams, Part 1," Water Resources Bulletin No. 6, December 1970.

BEST DOCUMENT AVAILABLE

Commonwealth of Pennsylvania, Department of Property and Supplies, Pennsylvania Manual 1970-1971, Volume 100, 1971.

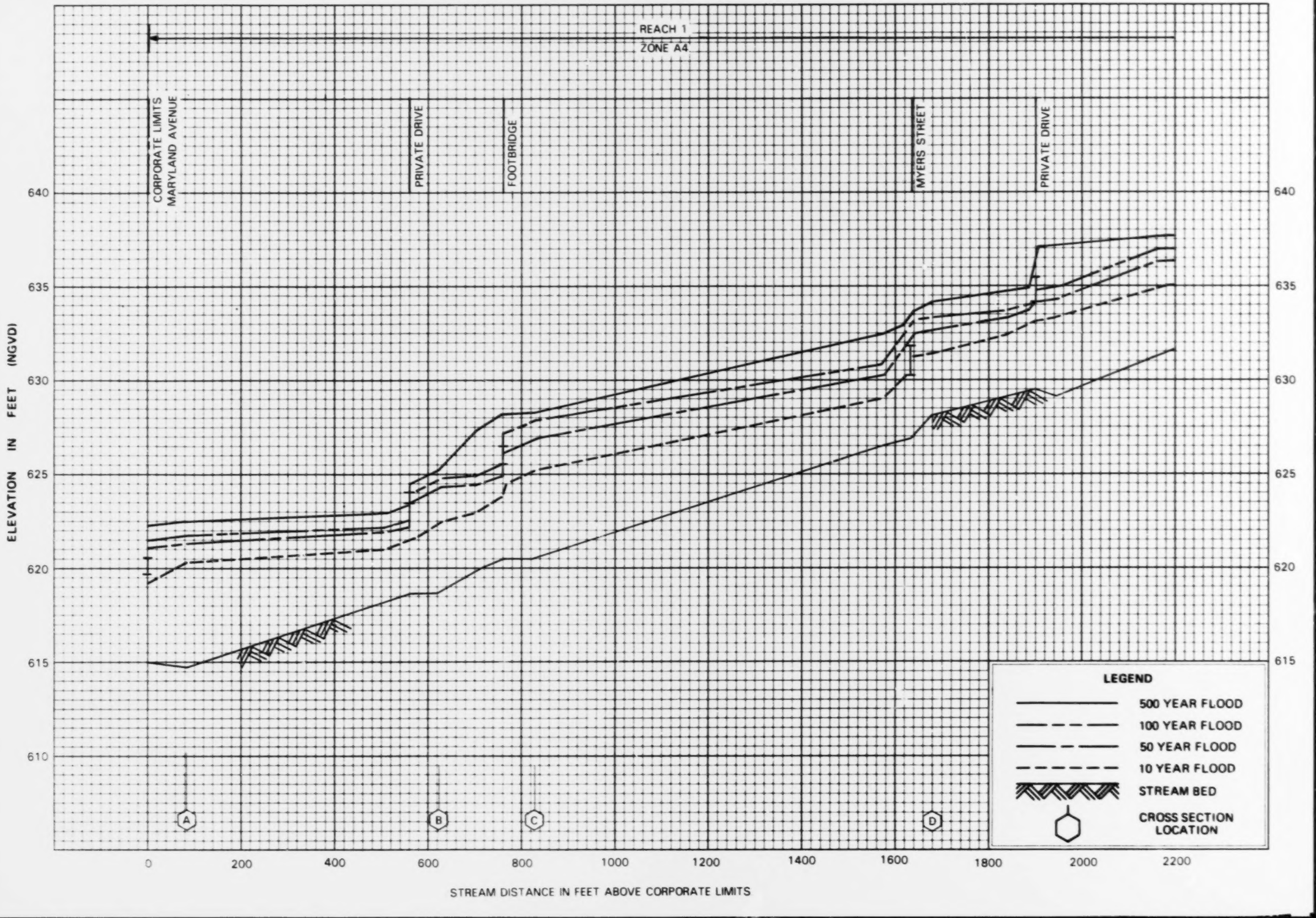
King, H. W., and Barter, E. F., King's Handbook of Hydraulics, 5th Edition, McGraw-Hill Book Company, 1963.

U. S. Department of Agriculture, Soil Conservation Service, National Engineering Handbook, Section 4, Hydrology, 1972.

U. S. Department of Agriculture, Soil Conservation Service, Statewide Soil Survey Map, U. S. Government Printing Office, 1970.

U. S. Department of the Interior, Bureau of Reclamation, Design of Small Dams, 1974.

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

FISHING CREEK

federal emergency management agency

BOROUGH OF WINDSOR, PA
(YORK CO.)

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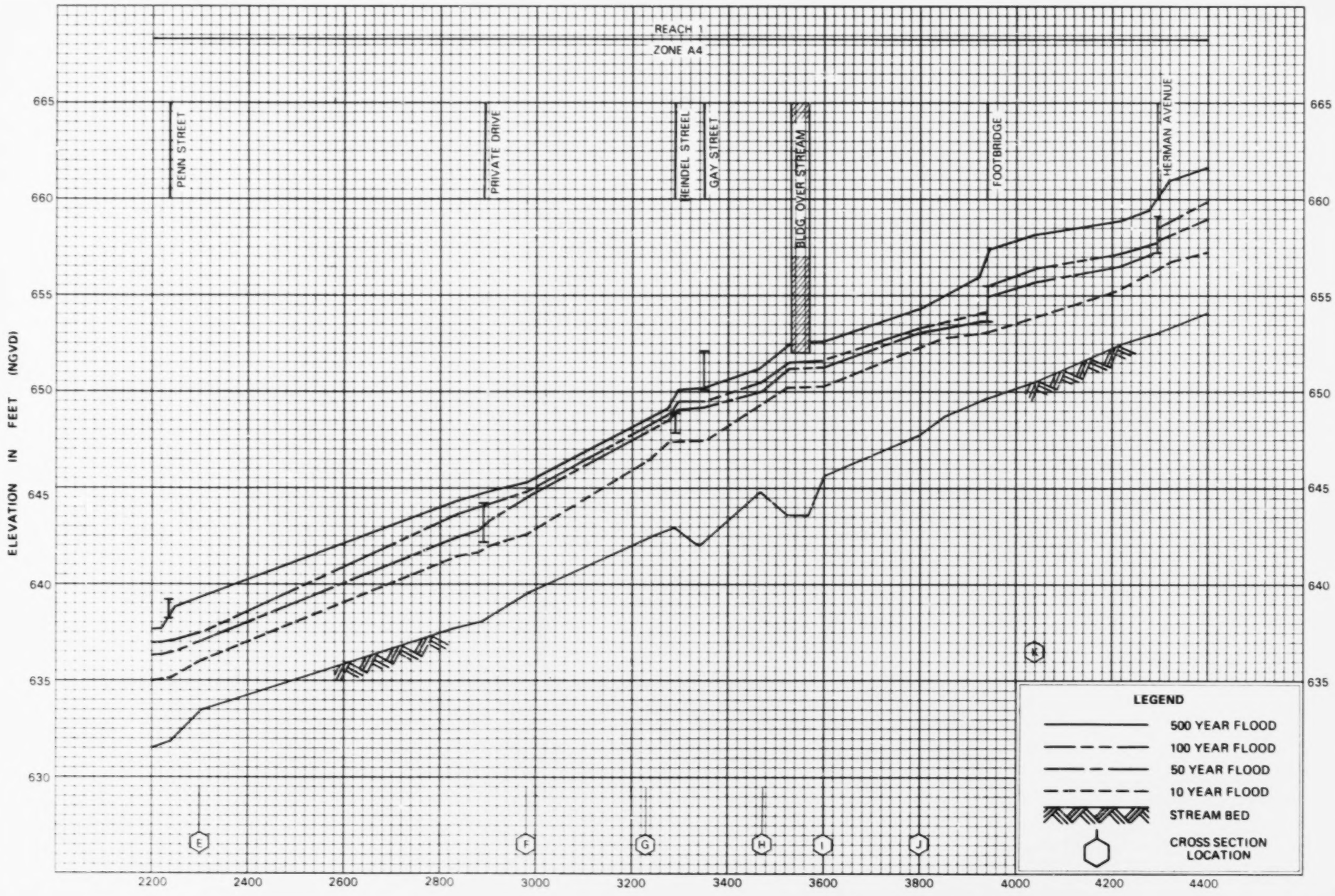

FLOOD PROFILES

FISHING CREEK

federal emergency management agency

BOROUGH OF WINDSOR, PA
(YORK CO.)

02P

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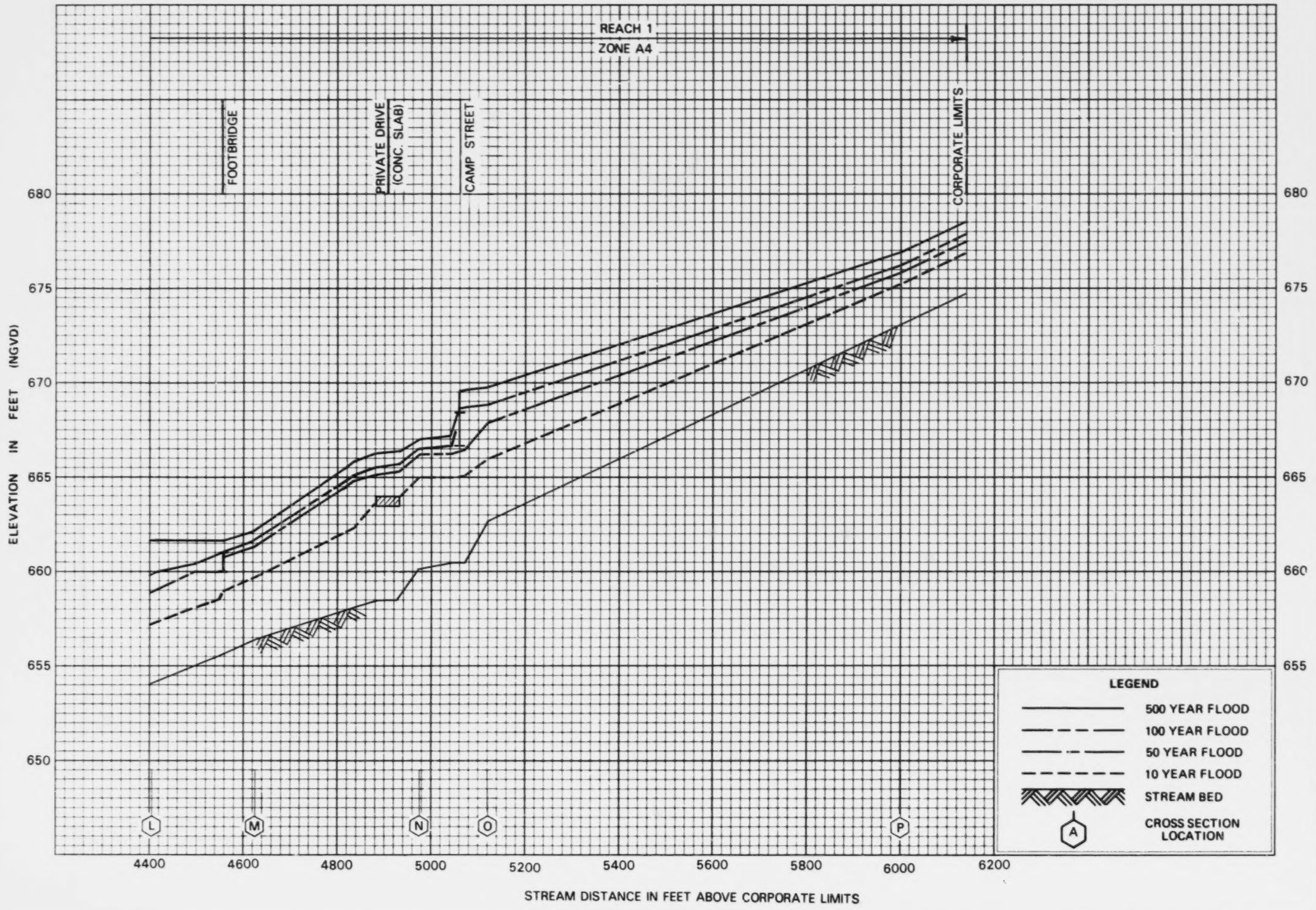

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